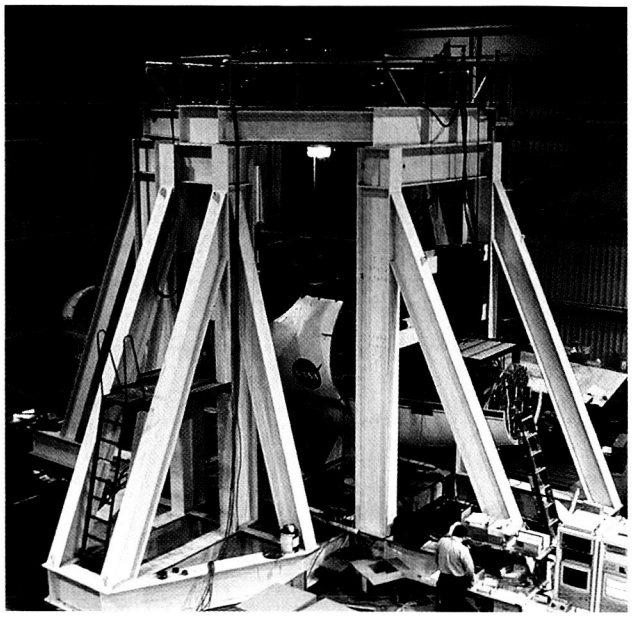

Fig. 2. LRTA rotor balance calibration facility.

actuators, allowing for dynamic high-frequency blade pitch control up to 30 hertz.

With these major milestones met, the LRTA is now ready to become the workhorse facility for NASA's large-rotor experimental programs.

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A Study of Dynamic Stall Using Two-Dimensional Oscillating Wing Experimental Data

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Dynamic stall produces a significant limitation on the operation and performance of rotorcraft at high-speed. To understand this complex and unsteady aerodynamic phenomenon, a number of studies have been performed to obtain and analyze test data from nonrotating oscillating wings in wind tunnels. Many of these experiments have failed to generate sufficient information to capture the complicated aerodynamic flow characteristics occurring during the dynamic stall process. However, data from one test are now available that afford an opportunity for detailed analysis.

The Army Aeroflightdynamics Directorate performed the test at Ames Research Center in a 7- by 10-foot wind tunnel. The objective of the experiment was to produce high quality data of two-dimensional (2-D) and three-dimensional (3-D) dynamic stall on a semi-span and full-span wing undergoing pitching motions designed to simulate typical rotor blade motions. The airfoil section, a NACA 0015, was tested at a Mach number of 0.3. Various tests were performed for a combination of parameters such as pitch oscillation amplitudes and reduced frequencies. Results from this experiment included the integrated measurements from pressure transducer arrays in the form of lift, drag, and pitching moment coefficients at various wing span locations. Instantaneous pressure distributions have now been made available as a part of the present work; examples are shown in figures 1 and 2.

The initial work here has focused on the 2-D data of the Army experiment to study the vortex development during the dynamic stall process under different test conditions. Detailed analysis has been completed to better understand the flow characteristics of the NACA 0015 airfoil undergoing dynamic motion during dynamic stall. Additionally, the flow behavior data of the NACA 0015 airfoil in this experiment has been compared with NACA 0012 airfoil data previously obtained under similar operating conditions in the same 7- by 10-foot wind tunnel.

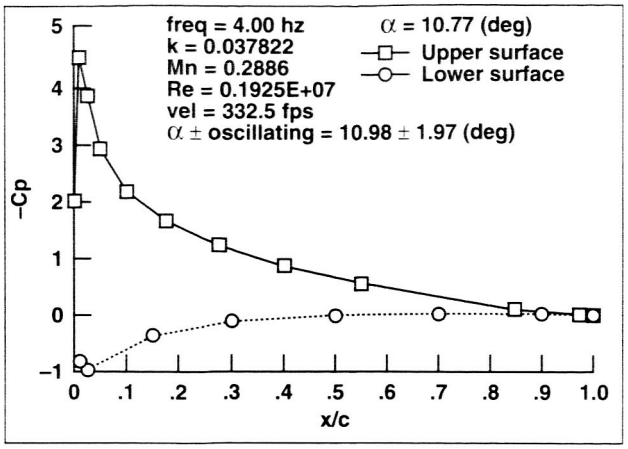

Fig. 1. AFDD 2-D and 3-D oscillating wing experiment upper and lower surface pressures versus chord location (50.0% span).

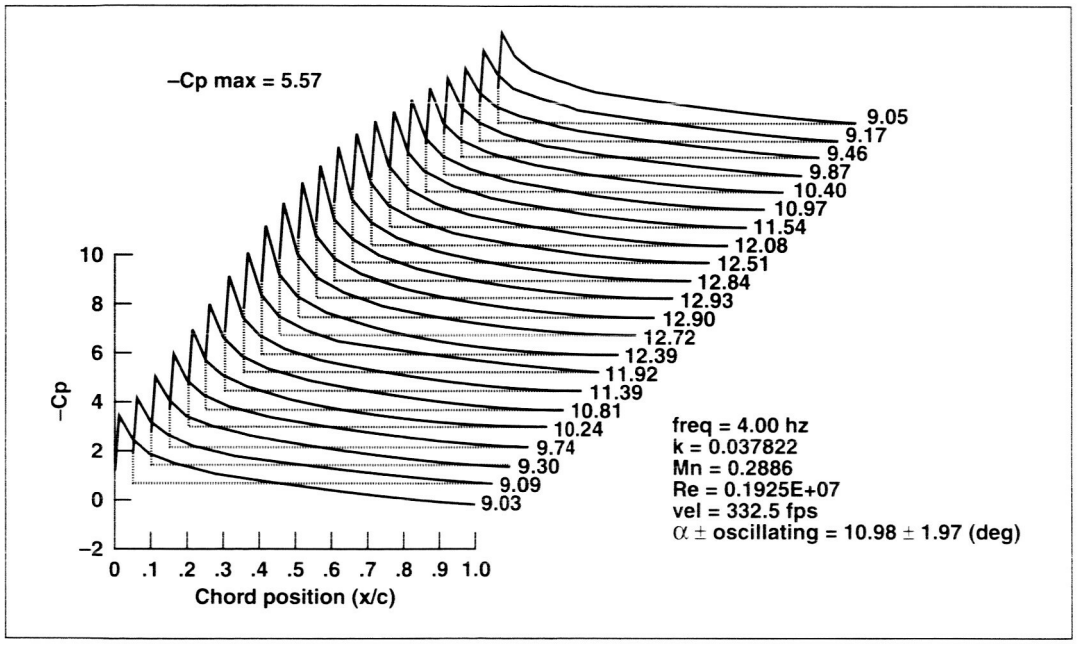

Fig. 2. AFDD 2-D and 3-D oscillating wing experiment upper surface pressure versus chord location with pitch angle during prescribed pitch motion (50.0% span).

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